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Assimilation of SAR and optical data into an agrometeorological model for monitoring yield of corn

Maël Ameline [a, c] ; Rémy Fieuzal [a] ; Julie Betbeder [b] ; Jean-François Berthoumieu [c] ; Frédéric Baup [a]

[a] *Centre d'Etudes Spatiales de la BIOsphère—Université de Toulouse, France; e-mails: mael.ameline@gmail.com; remy.fieuzal@cesbio.cnes.fr; frederic.baup@cesbio.cnes.fr*

[b] *UMR 6553 ECOBIO, CNRS Université de Rennes 1, Campus de Beaulieu, 35042 Rennes Cedex, France; e-mails : betbederjulie@gmail.fr*

[c] *Association Météorologique de Moyenne-Garonne et du Sud-Ouest (ACMG) – AGRALIS, Aérodrome d'Agen 47 520 Le Passage; e-mails : acmg@acmg.asso.fr*

Abstract: This study aims to assess the contribution of SAR and optical satellite images to estimate corn biophysical parameters and crop yield at field scale. Satellite data are assimilated into a simple agro-meteorological model named SAFY-WB (Simple Algorithm For Yield estimates combined with a Water Balance model), in order to simulate leaf area index, dry mass and yield. The method has been assessed thanks to data collected over two study areas (both located in the South-West of France), during two experimental campaigns: MCM'10 and MCM'15 (Multispectral Crop Monitoring), respectively performed in 2010 and 2015. SAR backscattering coefficients were acquired in the C-band, and extracted from two satellites: Radarsat-2 (full-polarization states) and Sentinel-1 (VV and VH polarizations) in 2010 and 2015 respectively. Vegetation indices (NDVI, MTVI2) have been extracted from optical images at high spatial resolution (i.e. Landsat, Spot and Formosat satellite missions).
First results demonstrate that optical and SAR ($\sigma°_{HV}$) data can be used for monitoring leaf area index and dry mass of the corn during the growing period, until flowering. From the end of the growing period and during the senescence, the SAR signals saturate and are weakly sensitive to the decrease of the crop water content, contrary to optical reflectance that strongly decrease with the color change of leaves and stems. Consequently, the best approach consists in assimilating SAR or optical data until flowering and mainly assimilating optical data from flowering to harvest, for best performances in the monitoring of yield, leaf area index and dry mass of corn.

Keywords: maize, crop yield, microwave, optical, remote sensing, biomass, LAI, assimilation